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AUTHOR Borys, Suzanne V.
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ABSTRACT

The effectiveness of verbal and imaginal elaborations on the free recall of 50 educable mentally retarded adolescents was investigated. Ss were assigned to one of five conditions: experimenter-imposed verbalization (EV), experimenter imposed imagery (EI), subject-generated verbalization (SV), subject-generated imagery (SI), and control (C). Ss saw 15 pictures, presented in sets of three for five trials, and were asked to recall the pictures after each trial. Over all trials combined, it was found that recall in the EV and EI conditions was reliably superior to recall in the C and SV conditions. Although retarded adolescents were capable of producing verbal or imaginal elaborations, as evidenced by post-experimental inquiry, elaborations facilitated learning only when they were supplied by the experimenter. (Author/SBH)

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Effect of Imposed Versus Self-Generated Imagery and Sentence Mediation on the Free Recall of Retarded Adolescents

One of the tasks confronting special educators is the utilization of techniques which will produce optimal learning in their students. An abundance of research with nonretarded subjects indicates that the use of imaginal or sentence elaborators greatly enhances their paired associate learning (Epstein, Rock, & Zuckerman, 1960; Milgram, 1967; Rohwer, 1970). Danner and Taylor (1973) have demonstrated that children as young as seven years old benefit from relational imagery training and suggest that this finding has classroom applicability in that students can be made "more aware of and more confident in their ability to improve their own learning efficiency" (p. 54).

Evidence has emerged that retarded students can also profit by the use of elaboration (e.g., Burger & Blackman, 1976; Lebrato & Ellis, 1974; Milgram, 1967; Moncrieff, 1974; Rohwer & Lynch, 1968; Turnure, 1971; Whitely & Taylor, 1973; Yarmey & Bowen, 1972; Zupnick & Meyer, 1975). Taylor, Josberger, and Knowlton (1972) found that educable mentally retarded (EMR) students given adequate training were able to generate elaborative contexts in the form of images or sentences which resulted in improved paired associate (PA) learning. Elaboration training was thus offered as a potential instructional method for increasing the learning rate and memory organization of EMR students.

In a follow-up study, Taylor, Josberger, and Whitely (1973) found that when EMR children overtly verbalized their elaborations, their PA learning was superior to subjects who kept their elaborations covert. Jensen and Rohwer (1963) also found that retarded subjects did significantly better in

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their PA learning when asked to form sentences connecting the stimulus and response terms than subjects who simply named the items. The authors concluded that retarded subjects did not spontaneously utilize mediators in PA learning.

A question that arises from these studies is whether subject-generated elaborators are more effective than experimenter-supplied mediators with EMR students. Danner and Taylor (1973) found that the cued recall of sixth graders was better when they were trained to generate their own images than when the experimenter showed already integrated pictures. However, there were no significant differences between the two conditions for first and third graders. Using college students, Bobrow and Bower (1969) found that subjects recalled more noun pairs if they generated their own linking sentences, than if merely read a sentence. The authors attributed this finding to superior sentence comprehension resulting from the discovery of relationships between the stimulus and response terms.

In two studies by Macmillan (1970; 1972) with EMR subjects, no significant differences were found in PA learning between subjects instructed to generate mediating sentences or required to repeat a sentence supplied by the experimenter. Consequently, one interest in the present study is to determine the relative effectiveness of subject-generated versus experimenter-imposed mediation with both images and sentences on the free recall of EMR children. Since retarded individuals typically do not employ efficient learning strategies or spontaneously organize incoming information (Spitz, 1966), it is hypothesized that these subjects will benefit more from experimenter-imposed elaborations than from self-generated elaborations.

A second variable of theoretical interest is whether sentence or imagery mediation produces better recall by EMR individuals. The elaboration research has shown that imagery can mediate the associative learning of EMR children. In fact Paivio (1969) cited research which indicates that, with concrete words, imagery mediators produce higher recall than verbal mediators. He suggested that the effectiveness of imagery mnemonics may be due to the fact that a dual-memory code is formed (both visual and verbal) and that spatial organization is a further facilitating feature of effective mediating images.

There seems to be equivocal results, however, concerning the efficacy of verbal versus imaginal elaborations in aiding the learning of EMR children. Milgram and Riedel (1969) found that experimenter-imposed sentence mediators were more effective than interacting images in improving the PA learning of their retarded subjects. In contrast, Taylor et al. (1972; 1973) found that self-generated imagery and sentence mediators produced the same high level of PA learning, with imagery displaying a slight advantage. It is predicted that in the present study imagery instructions will have a more facilitating effect on recall than sentence instructions. Also, it may be that the effectiveness of the two types of elaborators will interact with whether or not the subjects generate their own mediators.

Although the majority of research on verbal and imaginal elaboration has used the paired-associate paradigm, some work has been conducted with free recall. Mueller and Jablonski (1970) gave adult subjects grouping instructions and found that the free recall of those who formed mental images of words was superior to subjects who used sentences or their own strategy to combine the words. The present investigation employs a free

recall paradigm with pictures presented in sets. It is hypothesized, therefore, that EMR subjects given elaboration instructions or experimenter supplied elaborations will be better able to integrate the pictures into chunks. This should result in a reduction of the number of units to be recalled at the time of retrieval, and should be reflected in superior recall when compared with non-assisted control subjects. It is further predicted that imagery instructions will have a relatively greater facilitating effect on recall than sentence instructions since imagery emphasizes the spatial organization of items.

Method

Subjects

The subjects were 50 educable mentally retarded adolescents drawn from a State institution in New Jersey. The mean IQ of the sample was 66.2, with a standard deviation (SD) of 3.91, mean chronological age (CA) = 18.01 years, SD = 2.74, and mean mental age (MA) = 10.4 years, SD = .89.

Stimuli

The stimuli were 15 easily identifiable chromatic pictures of animate and inanimate objects which were drawn on 5 cards, with each card containing 3 pictures. Two versions of the five-card sets were prepared. In one set, three objects were drawn side by side horizontally on each card, e.g., a picture of a mailbox, next to which was a sitting dog, next to which was a kite (with string and tail). In the second version, the same three objects were drawn on a single card, but they were interacting with each other, e.g., the dog was sitting on the mailbox and flying the kite (by holding the string in his mouth). The pictures were drawn with colored pencil on 20.32 cm X 27.94 cm white posterboard cards. Two Lafayette timers (Model No. 50010) were

used to prepare a cassette tape with 2.4 KHz tones of .5-sec duration, spaced at the appropriate intervals, to cue the experimenter for stimulus presentation.

Materials and Procedure

The subjects, tested individually, were told they were going to see some pictures that they should try to remember. Each card was hand displayed by the experimenter for 21 sec in order to allow the subject sufficient time to form a sentence or imaginal mediator. There were five trials, with each trial consisting of the five cards sequentially presented, in one of five presentation orders. Each card appeared in a different list position over the five trials in order to control for serial position effects. A 90-sec recall period after each trial was signalled by a sixth card containing a question mark. Following the 90-sec recall period there was a 20-sec inter-trial interval during which the experimenter rearranged the cards.

A practice-training session preceded the experiment in order to insure that subjects understood the task, and to determine whether those in the self-generated mediation conditions were capable of producing mediators. This session consisted of three, three-picture practice cards (not used in the main experiment), and lasted approximately 8 minutes. During training, subjects were given instructions appropriate to the condition to which they were assigned. Complete instructions are given in Appendix A.

Condition

1. Experimenter-Imposed Verbalization (EV). Subjects were shown sets of separated pictures (i.e., non-interacting), with a sentence supplied by the experimenter for each set. The sentences used during practice were:

1) A FIRE is burning in the PAN on the CHAIR, 2) The FISH with the HAT is smoking a PIPE, and 3) The GLASSES are hanging by a CHAIN from the AIRPLANE. Those used during the test were: 1) The DOG on the MAILBOX is flying a KITE, 2) The SCISSORS are cutting the PUMPKIN on the TABLE, 3) The SNOWMAN in the BOAT is waving a FLAG, 4) The TRUCK with the UMBRELLA is driving over the TREE, and 5) The HAND is hitting the DRUM with a COMB.

2. Experimenter-Imposed Imagery (EI). The subjects were shown the sets of objects which were interacting in the same manner described by the experimenter-imposed verbalization, e.g. A picture showing a HAND hitting a DRUM with a COMB.

3. Subject-Generated Verbalization (SV). Subjects saw non-interacting pictures and were given training on making up a sentence to relate the three pictures in each set.

4. Subject-Generated Imagery (SI). Subjects were shown sets of non-interacting pictures, e.g. HAND-DRUM-COMB. During the practice session subjects received training on integrating the three pictures into a scene or image.

5. Control (C). Subjects were shown non-interacting pictures and simply asked to remember the pictures by thinking about them.

On the first trial only, subjects were asked to name all the pictures; if they did not know a picture, the experimenter supplied the correct label. This occurred 3.5% of the time. During the experiment proper, subjects were discouraged from overt verbalizations. On the first trial the experimenter reminded subjects in the subject-generated verbal and imagery conditions to use the "special way" of remembering when each picture set appeared;

thereafter the experimenter gave this reminder only at the beginning of each trial. Subjects in these conditions were also told in advance that when the experiment ended, the experimenter would ask them what sentences/images they used for each picture set.

Results

A 5X5 (conditions X trials) repeated measures analysis of variance performed on the number of pictures recalled over 5 trials yielded significant main effects for condition, $F(4,45) = 5.42$, $p < .01$, and trials, $F(4,180) = 46.24$, $p < .01$. There was no significant interaction. A summary of the analysis of variance is presented in Table 1. Tukey b tests among conditions indicated that significantly more pictures were recalled in the EI and EV

Insert Table I about here

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conditions (which did not reliably differ) than in the C or SV conditions ($p < .05$); recall among the SI, SV and C conditions did not reliably differ.

Tukey b tests were also used to test the effects of trials. Recall on Trial 5 was better than on Trials 3, 2, and 1; recall on Trials 4 and 3 was superior to recall on Trials 2 and 1; and recall on Trial 2 was superior to recall on Trial 1 ($p < .05$). Figure 1 presents the mean number of pictures recalled for each experimental condition by trial.

Insert Figure 1 about here

To assess the immediate effect of the different treatments, Trial 1 performance was examined. Tukey b tests indicated that recall performance in the EI, EV, and SI conditions, which did not reliably differ, was superior to performance in the C group ($p < .05$). Also, recall in the EI condition

Table I

Summary of Analysis of Variance for Total Number of Pictures Recalled by Trial

Source	SS	df	MS	
Between Subjects	1786.68	49	---	
Conditions (C)	580.58	4	145.14	5.42*
Error between	1206.10	45	26.80	
Within Subjects	1479.40	200	---	
Trials (T)	719.46	4	179.86	46.24*
C X T	58.74	16	3.67	.94
Error within	700.20	180	3.89	

*p < .01

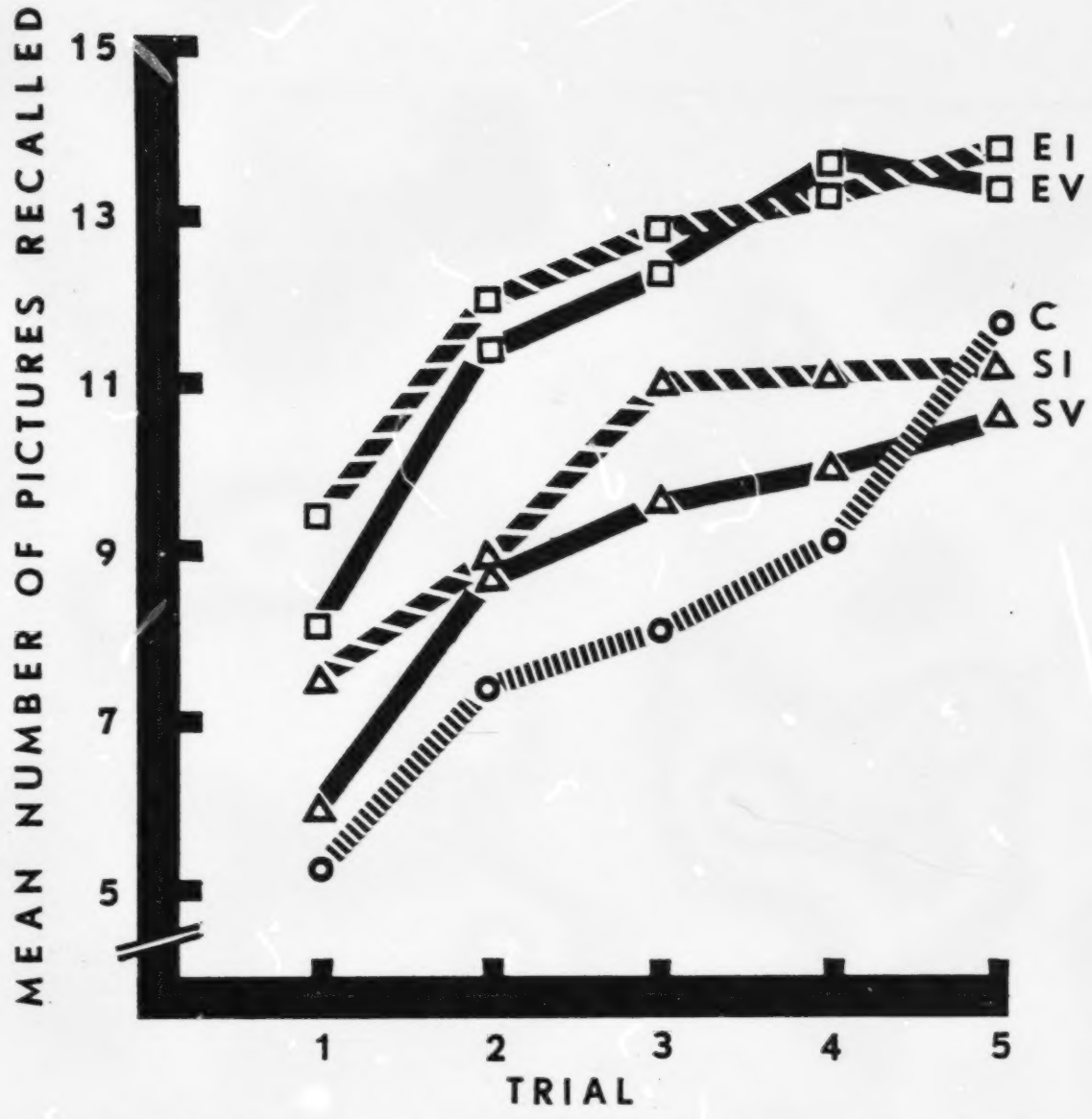

Fig.1. Mean number of pictures recalled for each experimental condition by trial.

was better than that in the SV condition ($p < .05$). Apparently retarded adolescents were able to generate imaginal elaborators in the SI condition to facilitate their recall very shortly after training; however, the beneficial effect of self-generated imagery mediation did not last. When performance over all 5 trials was examined, performance in the SI group was no longer significantly better than in the C group.

Clustering. To determine whether certain conditions had a more unitizing effect on recall than others a measure of clustering was formulated. The ratio of the number of complete picture triplets recalled to the total number of pictures recalled was computed for each subject at every trial. A picture triplet was counted only if all three pictures comprising the set were recalled consecutively (i.e., in the same manner in which the pictures were grouped during presentation). Thus the number of three-picture sets which could be consecutively recalled ranged from 0 to 5, while the total amount recalled could range from 0 to 15. Consequently, clustering values, as determined by this ratio, ranged from 0, indicating no clustering, to .33, which indicated perfect clustering. Extra-list intrusions and repetitions were ignored.

A 5 X 5 (conditions X trials) repeated measures analysis of variance performed on the amount of clustering over 5 trials yielded significant main effects for condition, F (4, 45) = 3.14, $p < .05$, and trials, F (4, 180) = 13.94, $p < .01$. There was no significant interaction. A summary of the analysis of variance is presented in Table 2. Tukey b tests among

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Insert Table 2 about here

Table 2

Summary of Analysis of Variance on Mean Amount of Clustering Per Trial

Source	SS	df	MS	F
Between Subjects	2.555	49		
Conditions (C)	.557	4	.139	3.139*
Error between	1.998	45	.044	
Within Subjects	1.223	200		
Trials (T)	.261	4	.065	13.938**
C X T	.117	16	.007	1.568
Error within	.845	180	.004	

*p < .05

**p < .01

conditions indicated that there was significantly more clustering in the EI condition than in the control condition ($p < .05$). Figure 2 presents the mean amount of clustering for each experimental condition by trial.

Insert Figure 2 about here

Tukey b tests were also used to test the effect of trials on clustering. Over all conditions combined, the amount of clustering for Trial 5 was greater than for Trials 3, 2, and 1; clustering for Trial 4 was superior to Trials 2 and 1; and clustering for Trials 3 and 2 was better than for Trial 1 ($p < .05$).

Subject-Generated Mediators. Upon termination of the experiment, the experimenter showed the SV and SI subjects each stimulus set, and wrote down the mediators they reported using. This post-experimental inquiry indicated that all subjects were capable of producing adequate sentence or imaginal mediators for each picture set. Some differences between the two types of elaborations were noted. Approximately 44% of the mediators for the SV group consisted of three separate sentences or phrases for each set, whereas this rarely occurred in the SI condition. Consequently performance in the SV condition may have been hindered since items were not being effectively chunked by subjects to reduce information, but rather, were being remembered as single units. Also many of the sentences produced by the SV group related to the functional aspects of the stimuli, e.g., "You can eat on a table," "put the letter in the mailbox," "comb for hair," etc. Descriptions from the SI subjects tended to related objects by spatial position, e.g., "The pumpkin is on the table with the scissors," and often gave descriptions

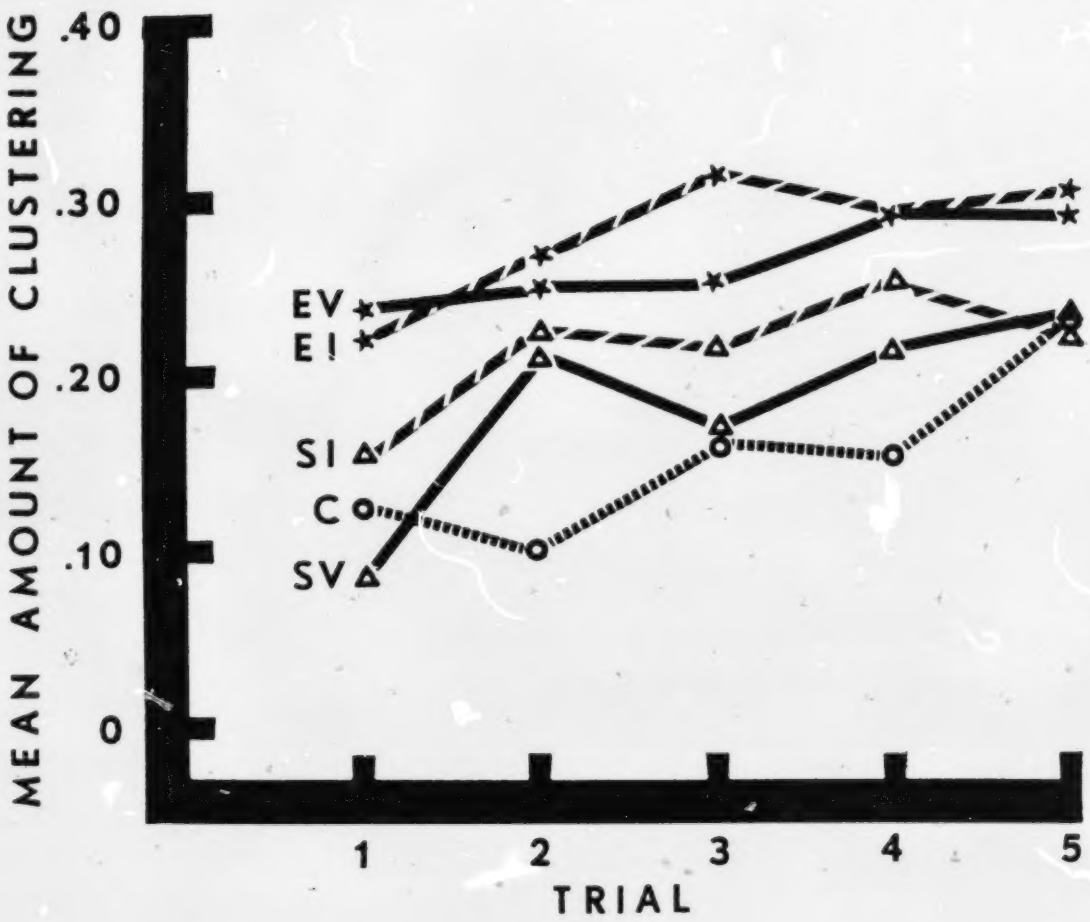

Fig.2. Mean amount of clustering for each experimental condition by trial.

corresponding to the interacting images used in the EI condition. Although sentences in the SV group might be considered more 'meaningful', the SI elaborations which were 'locational' in nature, appeared to be more effective mediators, since performance for this group did not differ significantly from the EI or EV groups.

Discussion

Results of this experiment indicate that elaboration, whether in the form of images or sentences, improves the learning of EMR adolescents when the experimenter supplies the mediators, but not when subjects are trained in generating their own elaborations. This finding contrasts with previous research using the PA paradigm, in which the learning of retarded subjects trained to generate mediators was superior to controls. It may be that free recall is less sensitive to the beneficial effects of mediation training.

Jensen and Rohwer (1963) found that although sentence mediation improved the PA learning of their retarded subjects, it had no facilitative effect on serial learning. These authors concluded that the types of mediation important to serial learning, perhaps serial position, was quite different from the type that operates in PA learning. It is suggested that in the present study the spatial organization inherent in the presentation of picture triplets may have mediated free recall, thereby reducing the larger effects demonstrated in PA learning, where more sophisticated strategies presumably are required. This hypothesis might be tested in a study which compares the presentation of items in groups with the sequential presentation of items. The experimenter noted a tendency for subjects in the control group to cluster their recall, i.e., they frequently recalled consecutive items from each picture triplet. This clustering may have resulted from the spatial contiguity of the stimuli and probably facilitated recall.

The clustering analysis indicated that there was significantly more clustering in the EI condition than in the control condition. It is speculated that the increased clustering of responses may have led to an increase in recall for this group. However, the EV group, which also exhibited a high level of recall, did not differ significantly from the control group in the amount of clustering shown.

No significant differences in recall were found between the sentence or imagery supplied mediators, indicating that both types of elaborators were equally effective. It might be noted that recall in both imagery conditions was at a higher (but not significant) level than the corresponding verbal conditions, in agreement with findings by Taylor et al. (1972; 1973). Of interest is the finding that the experimenter-supplied imagery and sentence conditions were superior not only to the control, but also to the subject-generated sentence conditions. This suggests that EMR students are less effective at generating sentences than images. Also, when the initial effect of treatments was examined, the recall of subjects who generated images was superior to controls. However, the effectiveness of this condition was temporary, and did not significantly differ from the control group when overall performance was examined.

It might be noted that in the present investigation subjects were not permitted to overtly verbalize their elaborations; such a procedure was viewed to be of limited classroom applicability. It had been hoped that with sufficient training, and periodic prompting by the experimenter, subjects would benefit from covert self-generated elaboration. Unfortunately, this did not occur. It may be that elaboration training only becomes

effective with EMR individuals when they are allowed to overtly verbalize. However, the fact that the learning of EMR individuals can be improved when the experimenter supplies mediators suggests that the use of elaboration is a potential special-educational method, even with tasks that do not require a great deal of associative learning, such as simple free recall.

APPENDIX A

Instructions

INSTRUCTIONS FOR EXPERIMENTER-IMPOSED VERBALIZATION

I am going to show you some sets of pictures that I want you to remember. We're going to do some practice first. I'll be reading you a sentence that connects each set of the three pictures. Here is a set. Would you please name the pictures? Here is my sentence that connects these three things. [E reads the sentence.] What was my sentence? Think about my sentence. [E covers up display set.] O.K. What were the three things you saw? Good. That's how I'll help you to remember the pictures, by reading a sentence that connects the three things.

Now we'll do another set. Would you please name the pictures? Here is the sentence I have for these three pictures. [E reads sentence.] Tell me the sentence I just read. [Keep set displayed for 20 sec. After 20 sec, cover the display.] Think about this sentence. O.K. What were the three pictures?

Let's try one more. Would you please name these? Now here is my sentence. [E reads sentence, displaying set for 20 sec.] What was my sentence? [After 20 sec, cover the display set.]
O.K. What were the three pictures?

When we start you will be seeing several sets of three pictures. For each set you will hear a sentence that connects the three things. When you see the question mark, tell me all the pictures you remember just seeing in any order you like.

INSTRUCTIONS FOR SUBJECT-GENERATED VERBALIZATION

I am going to show you some sets of pictures that I want you to remember. But first, I am going to show you a special way to remember the pictures. When you see a set of three pictures I want you to think of a sentence that connects the three things. Here is a set. Would you please name the pictures? I thought of a sentence that connects these three pictures and will tell you it. [E reads the sentence]. Think about my sentence. O.K. Can you remember my sentence? [E covers up display set.] What were the three things you saw? Good. That's now I want you to remember the pictures, by making up a sentence about the three things.

Now you make up a sentence about this set. Would you please name the pictures? Your sentence can be as funny or strange as you like. Make sure you connect the three pictures in one sentence. Tell me a sentence you can make up for this set. [Allow 20 sec, then cover the display set.] Now think about your sentence. O.K. What were the three pictures?

Let's try one more. Would you please name these? Now make up a sentence for these three pictures. Tell me your sentence. [Allow 20 sec, then cover display set]. O.K. What were the three pictures?

When we start you will be seeing several sets of three pictures. For each set make up a sentence connecting the three things but don't say it out loud. When you see the question mark, tell me all the pictures you remember just seeing in any order you like. [E will remind S to use this "special way" at the beginning of each trial].

INSTRUCTIONS FOR EXPERIMENTER-IMPOSED IMAGERY

I am going to show you some sets of pictures that I want you to remember. We're going to do some practice first. I'll be showing you a scene that connects each set of three pictures. Here is a set. Would you please name the pictures? See my picture shows these three things doing something together. Think about my picture. O.K. Can you describe what's happening? [E covers up display set.] What were the three things you saw? Good. That's how I'll help you remember the pictures, by showing you a picture in which the three things are doing something together.

Now we'll do another set. Here is the picture I have drawn for these three things. Would you please name the pictures? Think about the picture. Would you describe the picture I just showed you? [Allow 20 sec, then cover the display set.] O.K. What were the three things?

Let's try one more. Would you please name these? Think about this picture I have drawn that shows the three things doing something together. Would you describe the scene I just showed you? [Allow 20 sec, then cover the display set.] Good. O.K. What were the three things?

When we start you will be seeing several sets of three pictures. For each set you will see a picture that connects the three things. When you see the question mark, tell me all the pictures you remember just seeing in any order you like.

INSTRUCTIONS FOR SUBJECT-GENERATED IMAGERY

I am going to show you some sets of pictures that I want you to remember. But first I am going to show you a special way to remember the pictures. When you see a set of three pictures I want you to make up a picture or scene in your mind of the three things doing something together. Here is a set. Would you please name the pictures? I made up a picture in my mind about these three pictures and drew it on this card so you could see it. [Show interacting picture]. See they're all doing something together. Would you describe what's happening? Think about my picture. [E covers up picture and pauses briefly]. O.K., what were the three things you saw? Good. That's how I want you to remember the pictures, by making up a picture in your head about the three things doing something together.

Now you make up a picture or scene about this set. Would you please name the pictures? Your picture can be as funny or strange as you like. Make sure the three things are doing something together. Describe what you can do for this picture. Good. [Allow 20 sec, then cover display set]. Now think about your picture. O.K. What were the three things?

Let's try one more. Would you please name these? Now make up a picture in your head of these three things doing something together. Describe your picture to me. Good. [Allow 20 sec, then cover display set]. Think about your picture. O.K. What were the three things?

When we start you will be seeing several sets of three pictures. For each set make up a scene in your head of the three things doing something together, but don't tell me about it. When you see the question mark, tell me all the pictures you remember just seeing in any order you like. [E will remind S to use this "special way" at the beginning of each trial].

INSTRUCTIONS FOR CONTROL

I am going to show you some sets of pictures that I want you to remember. We're going to do some practice first. I'll be showing you cards which each have three different pictures on them. Here is one set. Would you please name the pictures? In order to remember these pictures I want you to keep thinking about these three pictures to yourself. [Pause for 20 sec, then cover the display set.] O.K. Did you keep thinking about the three pictures? What were the three pictures? Good. That's how you can help yourself remember the pictures, by thinking about three things you see.

Now we'll do another set. Would you please name the pictures? Remember - thinking about these pictures will help you to remember them when I ask you for them. [Pause 20 sec, then cover display set.] Did you keep thinking about the pictures? O.K. What were the three pictures?

Let's try one more. Would you please name these? Now think about the pictures so you'll remember them. [Pause 20 sec, then cover the display set.] Did you keep thinking about the pictures? O.K. What were the three pictures?

When we start you will be seeing several sets of three pictures. For each set I want you to keep thinking about the pictures you see so that you'll be able to remember them. When you see the question mark, tell me all the pictures you remember just seeing in any order you like.

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